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1000 वो० एसी० और 1500 वो० डीसी० तक खुले विद्युन्मय के लिए हस्त औजार

Indian Standard

HAND TOOLS FOR LIVE WORKING UP TO 1000 V AC AND 1500 V DC

(First Reprint JANUARY 2004)

UDC 621·315 — 783 : 621·88

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

February 1994 Price Group 11

Tools and Equipment for Live Working Sectional Committee, ET 36

NATIONAL FOREWORD

This Indian Standard which is identical with IEC Pub 900 (1987) issued by the International Electrotechnical Commission was adopted by the Bureau of Indian Standards on the recommendation of the Tools and Equipment for Live Working Sectional Committee (ET 36) and approval of the Electrotechnical Division Council.

The text of IEC standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are however not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'ISO Standards' appear in this standard, they should be read as 'Indian Standards.'

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence for the editions indicated.

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC Pub 50	IS 1885 Electrotechnical vocabulary	Technically equivalent
IEC Pub 50 (151) 1978	Doc : ET 01 (3432) Electrotechnical vocabulary : Part ... Electrical and magnetic devices	Identical
IEC Pub 60	IS 2071 Methods of high voltage testing	Technically equivalent
IEC Pub 743 (1983)	Doc : ET 36 (3576) Terminology for tools and equipment to be used in live working	Identical
ISO 2859 (1974)	IS 2500 (Part 1) : 1992 Sampling inspection tables : Part 1 Inspection by attributes and by count of defects (*first revision*)	Identical

The concerned technical committee has reviewed the provisions of IEC Pub 212 (1971) referred in this adopted standard and has decided that it is acceptable for use in conjunction with this standard.

Only the English language text in the international standard has been retained while adopting it in this Indian Standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

AMENDMENT NO. 1 JANUARY 2003
TO
IS 13772 : 1994/IEC Pub 900 : 1987 HAND TOOLS FOR LIVE WORKING UP TO 1 000 V AC AND 1 500 V DC

(*Second Cover, NATIONAL FOREWORD, para* 3) — Insert, to the text of publications quoted, the following publications:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 410 (1973) Sampling plans and procedures for inspection by attributes	IS 2500 (Part 1) : 2000 Sampling inspection procedures : Part 1 Attribute sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspections (*third revision*)	Technically equivalent
IEC 1318(1994) Live working — Guidelines for quality assurance plans	IS 14994 : 2001 Live working — Guidelines for quality assurance plans	Identical
ISO 1703 : 1983 Assembly tools for screws and nuts — Nomenclature	IS 6293 : 1996 Assembly tools for screws and nuts — Nomenclature (*second revision*)	Technically equivalent
ISO 5742 : 1982 Pliers and nippers — Nomenclature	—	—

(ET 36)

Price Group 9

Amend No. 1 to IS 13772 : 1994/IEC Pub 900 : 1987

Page 1

1 Scope

Replace the existing text after the second dash by the following:

- insulating rods and poles, used for working at a distance, which are covered by IEC 855.

2.1 *Assembly tools for screws and nuts*

Add, at the end of the existing text, the following phrase:

"... such as ISO 1703 and ISO 5742".

2.2 *Insulated hand tools*

Replace, "to avoid short-circuits" *by* "to minimize the risk of short-circuits".

2.3 *Insulating hand tools*

Replace the existing definition by the following:

Hand tools made predominantly of insulating material except for metal inserts:

- at the working head or active part, or
- used for reinforcement, but with no exposed metal parts,

in either case to protect the user from electric shocks as well as to prevent any short-circuit between phases or exposed parts at different potentials.

Add, on page 2, the following new definition:

2.6 *Formation of lots or batches*

The product is assembled into identifiable lots, sub-lots, batches,or in such other manner as may be prescribed (see 5.4 of IEC 410). Each lot or batch, as far as practicable, consists of units of product of a single type, grade, class, size and composition, manufactured under essentially the same conditions and essentially the same time (see IEC 1318).

Page 2

3 Requirements

Changes in the titles 3 and 3.1 apply to French text only.

3.1 *General requirements*

Subclause 3.1.2

Replace, in the first sentence of the first paragraph, "a similar function" *by* "the same function".

Add the new note as follows:

NOTE – Where no ISO standard is available, a standard specified by the customer (e.g. regional or national standard) should be used.

Subclause 3.1.3

Delete the last sentence of the second paragraph.

Delete notes 1 and 2.

Add the following new paragraph:

The design and construction of the handles shall provide a secure handhold and prevent unintentional slipping.

Page 3

Subclause 3.1.4

Add, after the second paragraph, the following new paragraph:

Tools intended for use at extremely low temperatures (–40 °C) shall be designated "Category C" and shall be designed for this purpose.

Delete the note.

Subclause 3.1.5

In the second line, replace "socket-wrenches" *by* "double-ended socket-wrenches".

Subclause 3.1.6

Replace the existing text by the following:

Tools capable of being assembled shall have suitable retaining devices to prevent unintentional separation of the assembly.

Subclause 3.1.7

In the first line, replace "requiring assembly" *by* "capable of being assembled".

Add, at the end of 3.1.7, the following new subclause and note:

3.1.8 Tools capable of being assembled and designed to be interchangeable between different manufacturers shall be specifically categorized and marked as such.

NOTE – The system of categorization and marking is under consideration.

3.2 *Additional requirements*

Corrections apply to French text only.

3.2.1 *Screwdrivers and wrenches*

Subclause 3.2.1.1

In the note, replace "purchaser" *by* "customer".

Replace the two dashes following the note by the following new text:

- engineers' wrenches: the working surface,

NOTE – At the request of the customer, the uninsulated area may be extended to the working head.

- box wrenches, socket-wrenches, tee wrenches: the working surface and the contact area.

Subclause 3.2.1.2

Replace the existing text by the following new text:

The blade insulation of screwdrivers shall be bonded to the handle. The outer diameter of the insulation, over a length of 30 mm, in area c of figure 1, shall not exceed by more than 2 mm the width of the blade at the tip. This area may be parallel or tapered towards the tip.

3.2.2 *Pliers, strippers, cable scissors, cable-cutting tools having legs up to 400 mm*

Delete, in the title, the phrase "having legs up to 400 mm".

In the first sentence, replace "leg" *by* "handle", *and replace* "cannot slip" *by* "is prevented from slipping".

At the end of the first paragraph, "as an example" *after* "see figure 2a".

In the second sentence, replace "to preclude the slipping" *by* "to prevent the slipping".

Page 4

After the second dash, replace "front" *and* "back" *by* "upper" *and* "lower part".

In the last sentence, replace "legs" *by* "handles".

Add, at the end of 3.2.2, the following new paragraph:

In case of "micro tools", the hand guard may be reduced. (Additional requirements are under consideration.)

3.2.3 *Tools with legs longer than 400 mm*

Delete the title of this subclause.

Add the existing text of 3.2.3 to subclause 3.2.2 and replace "legs" *by* "handles".

3.2.4 *Knives*

Renumber 3.2.4 to 3.2.3, as follows:

3.2.3 *Knives*

In the second sentence, replace "to preclude" *by* "to prevent".

Add the following new subclause 3.2.4:

3.2.4 *Tweezers* (see figure 14)

The total length 1 shall be 130 mm minimum and 200 mm maximum. The length of the handle g shall be 80 mm minimum.

Both handles of the tweezers shall have a guard towards the working head. The guard shall not be movable. Its height h and width b shall be sufficient (5 mm minimum) to prevent any slipping of the fingers during the work towards the uninsulated working head u.

On both handles, the insulated part between the guard and the working head e shall be 12 mm minimum and 35 mm maximum.

In the case of tweezers with a metallic working head, the metallic part shall have a minimum hardness of HRC 35 at least from the working head up to the handles.

The uninsulated length u of the working head shall not exceed a length of 20 mm.

Insulating tweezers shall not have exposed conductive parts.

3.2.5 *Marking*

Replace the existing text by the following new text:

Each tool and/or tool component shall be legibly and permanently marked with the following inscriptions:

a) on the insulating material layer or on the metal part:
   - marking of the origin (manufacturer's name or trade mark);

b) on the insulating material layer:
   - model/type reference;
   - year of manufacture (at least the last two digits of the year);
   - double triangle symbol with indication 1 000 V (i.e. the electrical working limit for alternating current). The symbol shall be at least 3 mm high; the letters and the figures shall be at least 2 mm (see figure 3);
   - for tools designed for use at extremely low temperature (–40 °C): letter "C";

c) additional marking for tools capable of being assembled and designed to be interchangeable between different manufacturers;

d) additional marking where specified by the customer (e.g. ownership mark).

The tools shall bear no voltage markings apart from those described above.

NOTE – For example, the indication of test voltage may lead to the assumption that the tool is suitable for work at that voltage.

Page 5

3.2.6 *Instructions for use*

Add the following new second paragraph:

Other instructions, such as verification before use and test methods, should be given by the manufacturer or the user (see annex D).

4.1 *General test specifications*

Replace the existing text by the following new text:

Compliance with the specifications in clause 3 shall be verified by means of the following type tests.

The tests specified in 4.2 to 4.10 shall be carried out on at least three tools of the same batch (see 2.8 of IEC 1318), and in the sequence of the subclauses mentioned.

If there is any change in the design or manufacture of the tool since the last type test, the type test shall be repeated.

Should a tool ail any part of the type test, the type test shall be repeated on at least six further tools of the same batch. Should any one of these six tools fail any part of the type test, the whole test shall be regarded as having been failed.

All tools that have failed the test shall be either destroyed or rendered unsuitable for use in live working. This also applies to any other tools from the batch unless the test is non-destructive. In this case, all tools shall be tested.

Unless otherwise stated, the test shall be carried out after a minimum storage time of 16 h under IEC climatic conditions, 23 °C ± 5 °C, relative humidity 45 % to 75 %.

Unless otherwise stated, tolerances of ±5 % from any test values required are permissible.

4.2.1 *Visual check*

In the first sentence, replace "stated to be free" *by* "shall be free".

4.3 *Low-temperature impact test*

Replace the title and the text of this subclause by the following:

4.3 *Impact test*

The test shall be carried out according to one of the two alternatives shown in figures 4a and 4b. The hardness of the hammer shall be at least 20 HRC.

At least three points of the insulating material or insulating layer shall be selected as testing points, these being points which could be damaged when the tool drops on a flat surface.

The test is successful if the insulating material shows no breaks, exfoliations or cracks penetrating the insulating layer of the insulated tool, or likely to reduce the solidity of the insulating tool.

Add, on page 6, the following new subclauses:

4.3.1 *Ambient temperature test*

The tool shall be tested at the ambient temperature, 23 °C ± 5 °C, of the test room.

The fall height H of the hammer shall be determined as a function of its weight P, so that the energy W of impact on the tool to be tested shall be equal to that of this tool falling on a hard surface from a height of 2 m:

$$H = \frac{W}{P} = \frac{2 \times F}{P}$$

where

H is the fall height of the hammer, in metres;

F is the weight of the tool tested, in newtons;

P the weight of the hammer, in newtons.

4.3.2 *Low temperature test*

The tool shall be conditioned by placement in a cooling chamber for 2 h at −25 °C ± 3 °C.

The impact test shall take place 120 s after removal from the cooling chamber. The ambient temperature shall be 23 °C ± 5 °C.

The fall height H of the hammer shall be determined as a function of its weight P, so that the energy W of impact on the tool to be tested shall be equal to that of this tool falling on a hard surface from a height of 0,6 m:

$$H = \frac{W}{P} = \frac{0{,}6 \times F}{P}$$

where

H is the fall height of the hammer, in metres;

F is the weight of the tool tested, in newtons;

P is the weight of the hammer, in newtons.

4.3.3 *Extreme low temperature test*

The tool shall be conditioned by placement in a cooling chamber for 2 h at −40 °C ± 3 °C.

The impact test shall be carried out according to 4.3.2.

Page 6

4.4.1 *Conditioning*

Replace the existing text of this subclause by the following:

Before testing, the tools shall be conditioned by total immersion in a bath of tap water at room temperature as specified in 4.1 (23 °C ± 5 °C) for 24 h ± 0,5 h. After this conditioning, the tools shall be wiped dry and submitted to the dielectric test.

In the case of tools capable of being assembled, the water immersion shall be replaced by a storage at a relative humidity between 91 % and 95 % at a temperature of 23 °C ± 5 °C for 48 h. Tools shall not be assembled prior to conditioning.

NOTE – This humidity may be obtained by storage in a closed chamber which contains a saturated solution of sodium sulphate decahydrate $Na_2 SO_4 10H_2O$ (Glauber's salt) having a large exposed surface.

4.4.2 *Insulated tools*

In the first line, replace "the test piece" *by* "the tool".

In the third paragraph, first line, replace "For tools with detachable heads" *by* "For tools capable of being assembled".

In the fourth paragraph, fourth line, replace "20 mm" *by* "200 mm".

Page 7

4.4.3 *Insulating tools*

Replace 4.4.3.1 and 4.4.3.2 by the following:

Tools having a metallic working head shall be tested according to 4.4.2.

Tools having no exposed metallic parts shall be tested as follows:

NOTE – The purpose of this test is to check the dielectric quality of the material used for the tool.

Electrodes of conductive tape or conductive paint, in 5 mm wide strips, shall be placed on the surface of the handle at intervals of 24 mm ± 2 mm (see figure 6), in accordance with IEC 60. A voltage of 10 kV r.m.s. at 50 Hz or 60 Hz shall then be continuously applied for 3 min between each adjacent electrode.

The test is successful if no electrical puncture, sparkover or flashover occurs during the test period, and if the leakage current is less than 0,5 mA multiplied by the number of spaces between the electrodes.

Page 9

4.6.4 *Test for adhesion of the insulation of the complete tool*

On page 10, after the first dash, replace "handle or legs remain" *by* "handle remains".

After, the second dash, replace "attached to the handle or legs" *by* "attached to the handles".

Page 10

4.7 *Flame retardancy test*

This correction applies to the French text only.

Page 11

4.8.2 *Insulating tools*

Add, on page 12, after 4.8.2.2, the following new subclause:

4.8.2.3 *Tweezers*

The required test is the same as for 4.8.2.2 a), the clamping force shall be not less than 10 N and shall not cause any permanent deformation.

Page 12

4.9.1 *Tools with spring-loaded balls*

In the first sentence, replace "For detachable tools" *by* "For tools capable of being assembled".

4.9.3 *Procedure and results*

Add, before the first paragraph, the following new sentence:

The tool shall be maintained in such position that the dismantling direction of the detachable part is vertical and downwards.

4.10 *Durability of marking*

Replace the first sentence by the following new sentence:

The tools shall be rubbed for 15 s with a rag soaked in water, and then for 15 s with a rag soaked in ethyl alcohol.

In the note, replace "purchaser" *by* "customer".

5 Routine tests

Add, before 5.1, the following new sentence:

Routine tests are performed to detect critical defects.

5.1 *Visual check*

Add to the existing sentence the following new sentence:

Tools failing the visual inspection shall be either repaired where that is a suitable means, or rejected where repair is not suitable or possible.

5.2 *Dielectric test*

Subclause 5.2.1

Add, on page 13, between the existing second and third dashes, the following new dash:

- the distance of the water level (or ball level) from the nearest exposed metal part shall be 24^{+4}_{-2} mm.

Subclause 5.2.2

In the first sentence, replace "Tools with detachable parts" *by* "Tools capable of being assembled".

Add the following new subclause:

5.2.3 Tools failing dielectric tests shall be rejected. All rejected tools shall be either destroyed or rendered unsuitable for live working.

6 Sampling tests

Replace the entire text of this clause by the following:

The sampling procedure shall be based on the type test procedures in conformance with annex C.

Page 14

7 Acceptance tests

In the existing text, replace "purchaser" *by* "customer".

Add the following new paragraphs:

The manufacturer shall keep records of all tests in accordance with the manufacturer's quality control procedures, for inspection by a prospective customer.

Records shall also be kept of any additional tests requested by the customer.

Add the following new clause:

8 Quality assurance plan

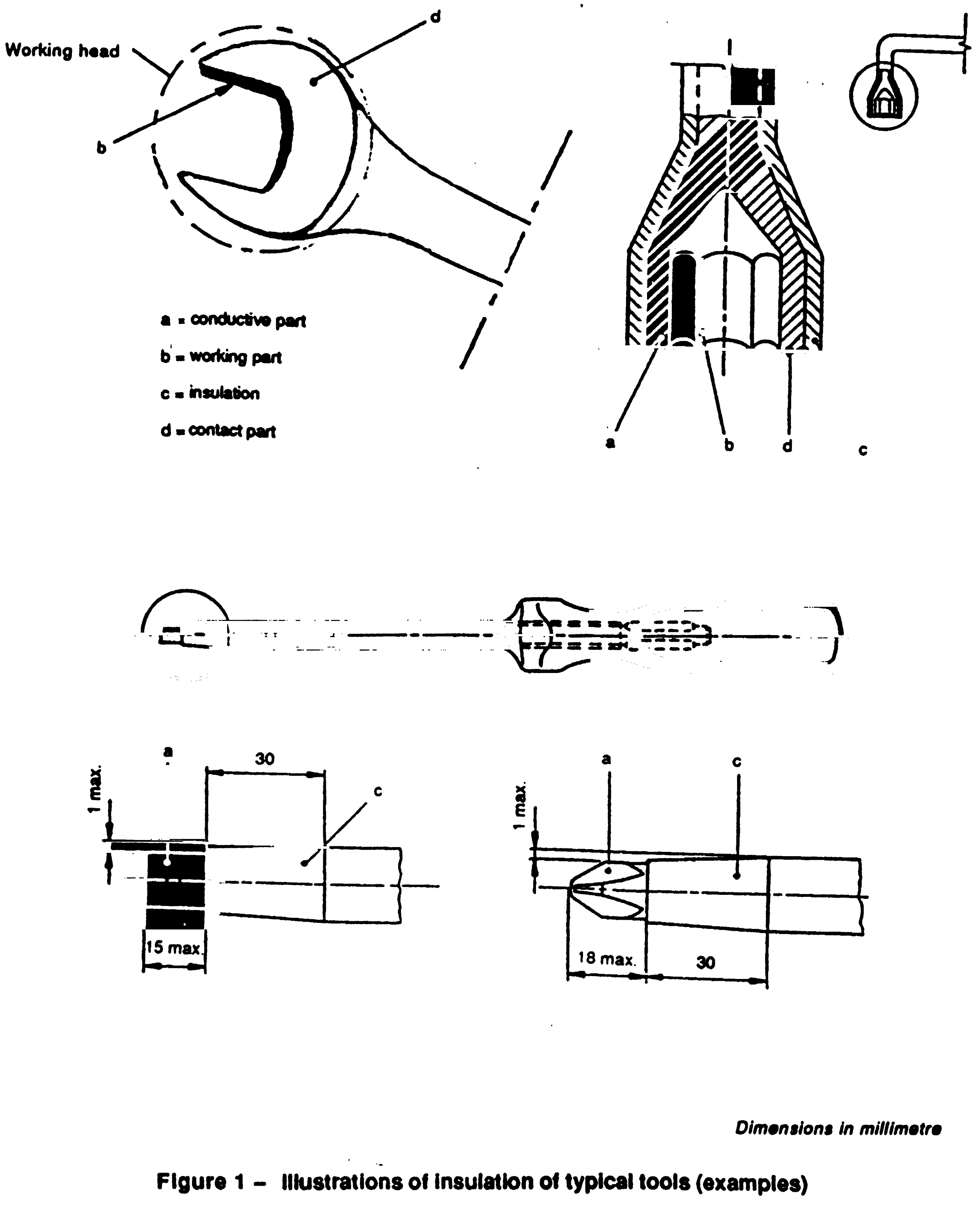
In order to assure the delivery of products that meet this standard, the manufacturer shall employ an approved quality assurance plan that complies with the provisions of ISO 9000 series.

The quality assurance plan shall ascertain that the product meets the requirement contained in this standard.

In the absence of accepted quality assurance plan as specified above, the sampling tests contained in this standard shall be carried out (see annex C).

Page 15

Replace the existing figure 1 by the following new figure:

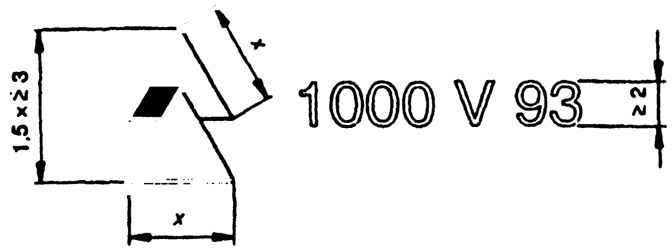


Dimensions in millimetre

Figure 1 – Illustrations of insulation of typical tools (examples)

Page 16

Replace the existing figure 3 by the following new figure:



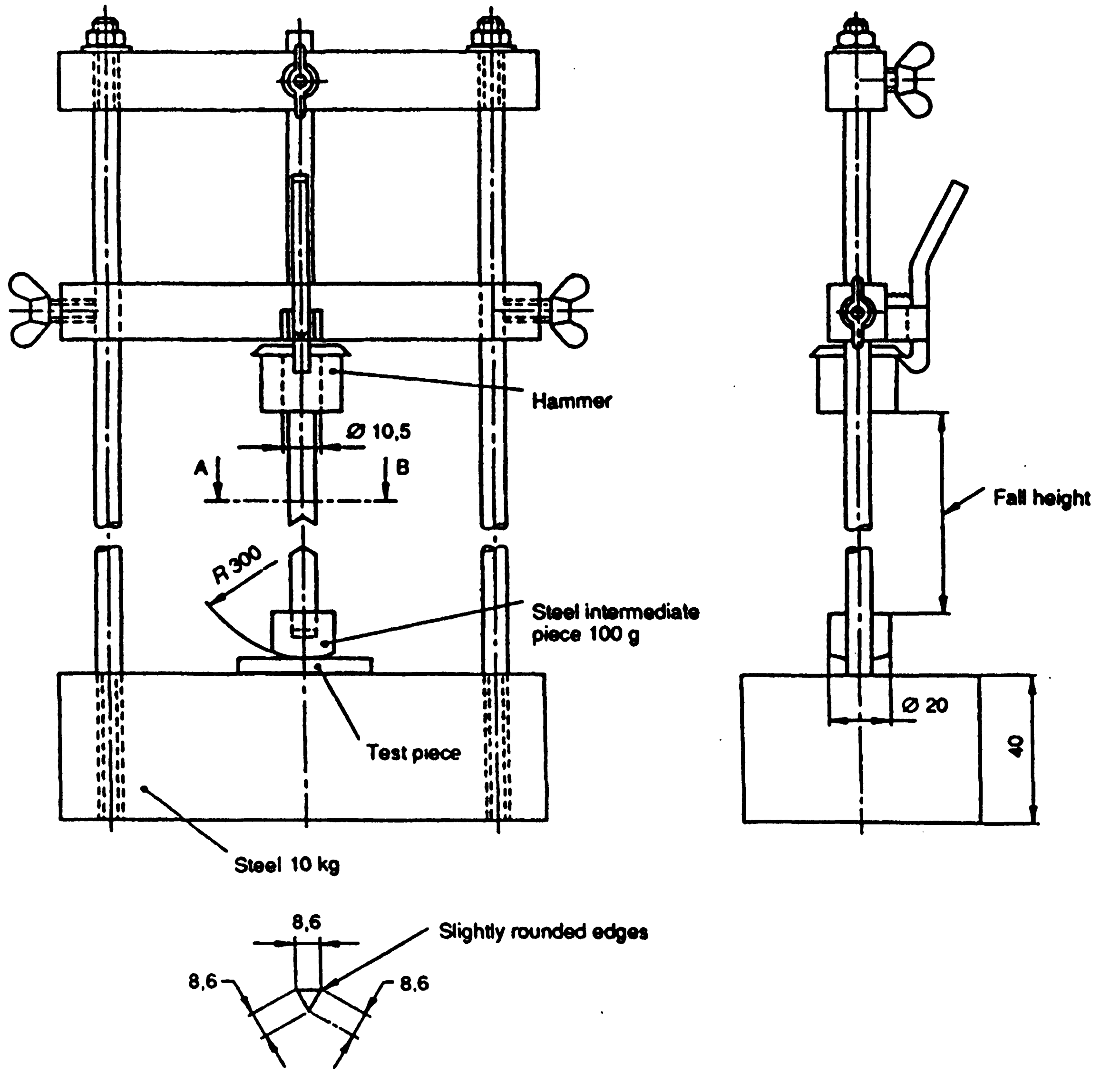
Dimensions in millimetre

Figure 3 – Marking symbol (see 3.2.5)

Page 18

Replace the existing figure 4b by the following new figure:

Method B



Section A-B

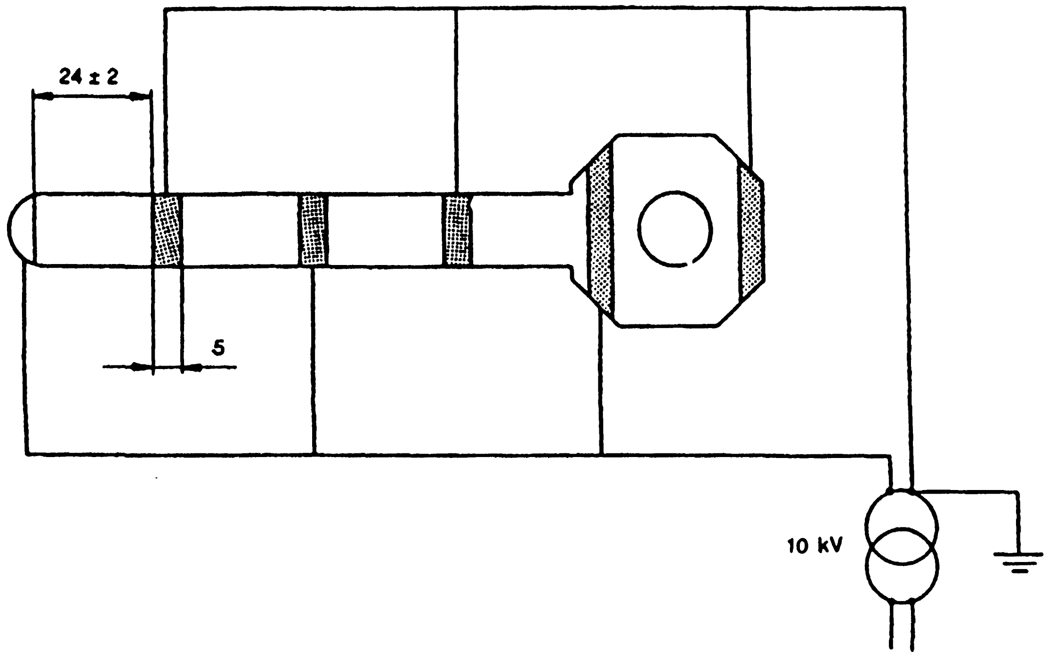
Dimensions in millimetre

Figure 4b

Figure 4 – Example of a test arrangement for impact test (see 4.3)

Page 20

Replace the existing figures 6a and 6b by the following new figure 6:

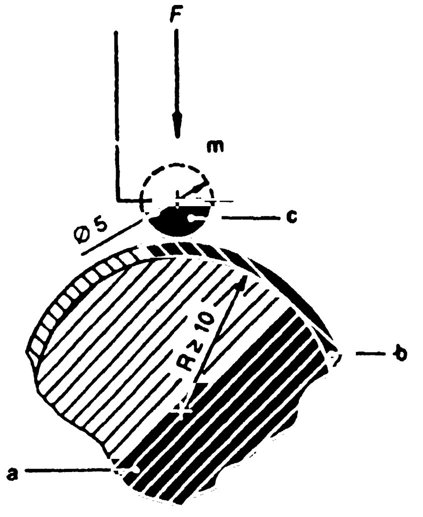


Dimensions in millimetre

Figure 6 – Dielectric testing device for insulating tools (see 4.4.3)

Page 21

Replace the existing figure 7 by the following new figure:



Dimensions in millimetres

a = conductive part

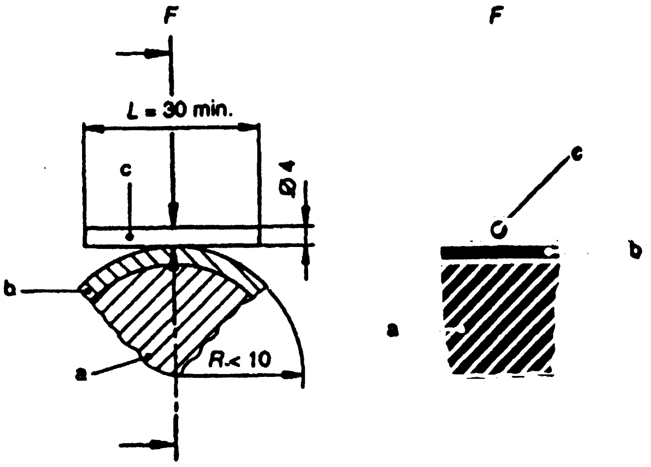
b = insulation (test point)

c = hemispheric nose-piece

R = radius at the test point of the tool

m = testing mass

Figure 7a – Radius at the test point of the tool ≥ 10 mm



Dimensions in millimetres

a = conductive part

b = insulation (test point)

c = rod

R = radius at the test point of the tool

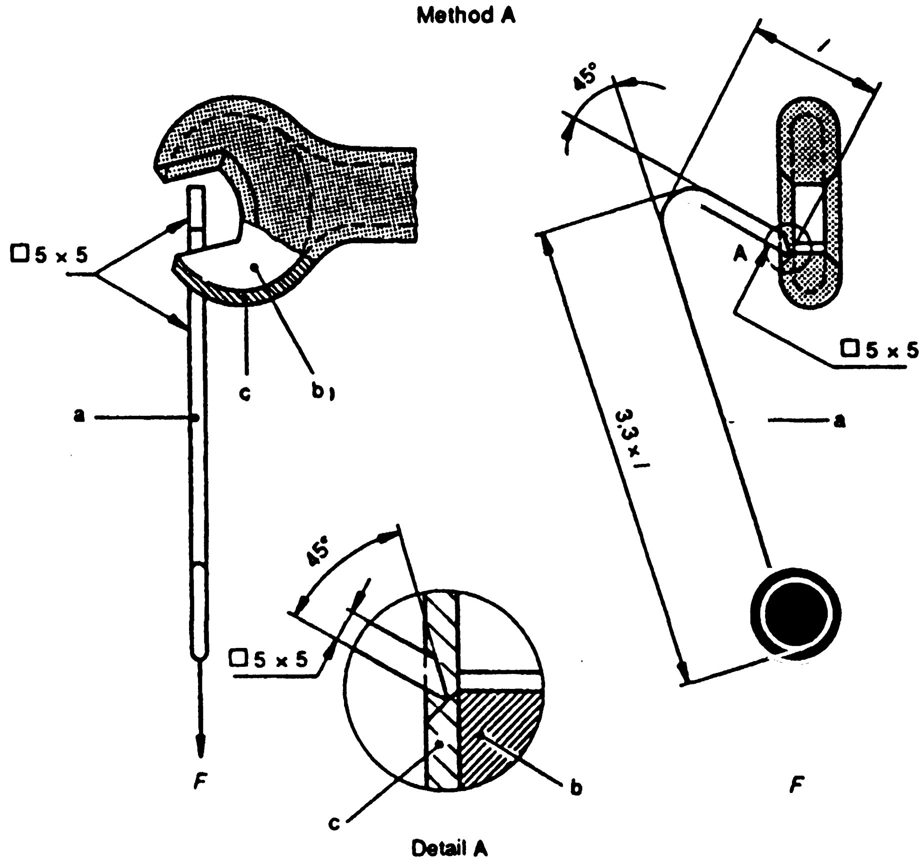
Figure 7b – Radius at the test point of the tool < 10 mm

Figure 7 – Indentation test (see 4.5)

Page 22

Replace the existing figure 8a by the following new figure:

Method A



Dimensions in millimetres

a = hook (the length of the handle depends on the size of the tool)

b = conductive part

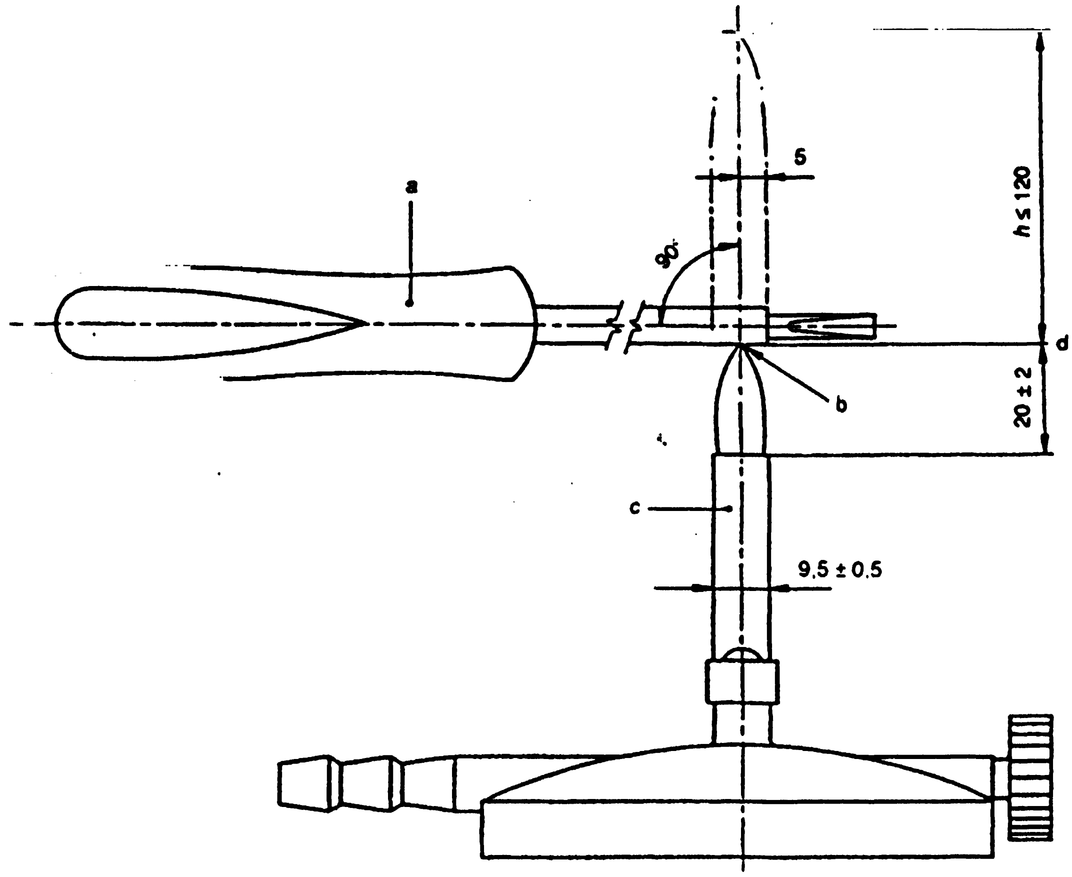
c = insulating material coating

l = length of the short arm of the hook

Figure 8a

Page 26

Replace the existing figure 11 by the following new figure:



Dimensions in millimetres

a = test piece

b = tip of the flame

c = burner

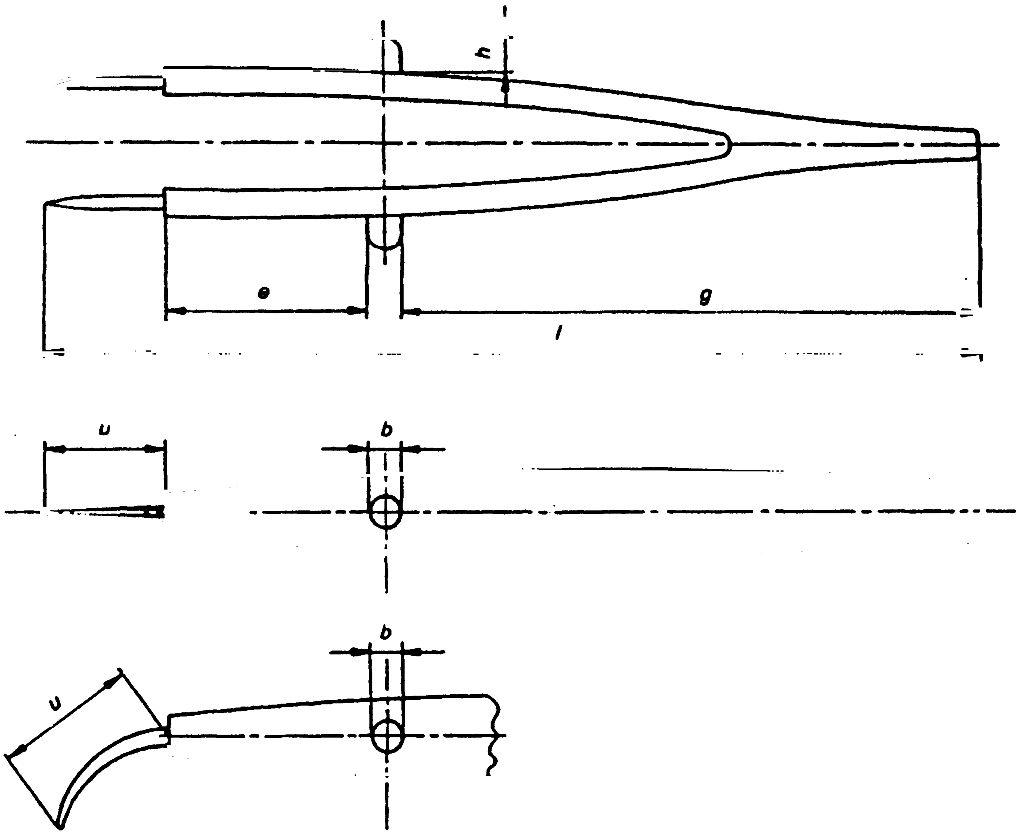
d = horizontal reference line

h = maximum flame height *h*

Figure 11 – Example of a flame retardancy test arrangement (see 4.7)

Page 28

Add, after figure 13, the following new figure 14:



l = total length of the tweezers

g = length of the handle (grip)

b = width of the guard

h = height of the guard

e = insulated part of the handle between the guard and the working head

u = uninsulated part of the working head

Figure 14 – Example for insulation of the handles of tweezers (see 3.2.4)

Page 28

Appendix A

Replace the title by the following new title:

Annex A
(informative)

Examples of calculation of the developed length of coating and acceptable leakage current

Page 29

Appendix B

Replace the title by the following new title:

Annex B
(informative)

Acceptance tests

Delete the last paragraph.

After annex B, add the following new annexes C and D:

Annex C
(normative)

Sampling procedure

C.1 General

The sampling procedure does not follow in its entirety the sampling procedure developed in IEC 410. The product covered by this standard does not lend itself to the application of the above mentioned standard, due to its nature.

The quality assurance plan used in conjunction with this standard on hand tools should be specially developed, based on the quality assurance practices of ISO 9000 series. If such a quality assurance system does not exist, the procedures in this annex are applicable.

C.2 Classification of defects

Defects are classified as major or minor (see definition in IEC 410).

The following table gives the nature of defects in relation with the tests specified for the sampling procedure

Table C.1 – Classification of defects

Description of test	Subclause	Minor defect	Major defect
Dimensional	4.2.2	X	
Impact	4.3		X
Dielectric	4.4		X
Indentation	4.5	X	
Adhesion	4.6		X
Flame retardancy	4.7	X	
Mechanical	4.8	X	
Locking	4.9	X	
Durability of marking	4.10	X	

C.3 General sampling plan

C.3.1 *Plans for major defects*

For major defects, table C.2 (with AQL 2,5) is limited to 35 000 units.

For lots equal to or larger than 35 001, use other test lots less than 35 000 according to table C.2.

Table C.2 – Major defects

Batch or lot size	Sample size	Acceptance number	Rejection number
Up to 15	2	0	1
16 - 50	3	0	1
51 - 150	5	0	1
151 - 500	8	0	1
501 - 3 200	13	1	2
3 201 - 35 000	20	1	2

C.3.2 *Plans for minor defects*

For minor defects table C.3 (with AQL 10) is limited to 35 000 units.

For lots equal to or larger than 35 001, use other test lots less than 35 000 according to table C.3.

Table C.3 – Minor defects

Batch or lot size	Sample size	Acceptance number	Rejection number
Up to 50	2	0	1
51 - 500	3	0	1
501 - 35 000	5	1	2

Annex D
(informative)

Recommendation for use and in service care

The following is for guidance only concerning the maintenance, inspection, retest and use of hand tools after purchase.

D.1 Storage

Hand tools should be properly stored to minimise the risk of damage to the insulation. Care should be taken that they are not stored in proximity to sources of heat such as steam pipes.

D.2 Inspection before use

Before use, each hand tool should be visually inspected by the user.

If there is any doubt concerning the safety of the tool it should either be scrapped or subjected to examination by a competent person and retested if necessary.

D.3 Temperature

According to their capability, tools should be used only in areas having temperatures between −20 °C and +70 °C and, for tools marked "C", between −40 °C and +70 °C.

D.4 Periodic examination and electrical retesting

An annual visual examination by a suitably trained person is recommended to determine the suitability of the tool for further service. If an electrical retest is required by national regulation or by customer specifications or in case of doubt after visual examination, the routine test will apply.

Reprography Unit, BIS, New Delhi, India

Indian Standard

HAND TOOLS FOR LIVE WORKING UP TO 1000 V AC AND 1500 V DC

1. Scope

This standard is applicable to insulated and insulating hand tools used for working live or close to live parts at nominal voltages up to 1 000 V a.c. and 1 500 V d.c.

Not included are:

- tools and equipment and material supplied from an external energy source;
- insulating rods and poles used for working at à distance.

2. Nomenclature and definitions

2.1 *Assembly tools for screws and nuts*

For nomenclature, refer to applicable ISO standards.

2.2 *Insulated hand tools*

Hand tools covered with insulating material in order to protect the user from electric shock and to avoid short-circuits between two parts at different potentials.

2.3 *Insulating hand tools*

Hand tools made entirely of insulating material with possible metallic inserts, in order to protect the user from electric shock and to avoid short-circuits between two parts at different potentials.

2.4 *Definition of tests*

The following terms are defined in accordance with Chapter 151 of the International Electrotechnical Vocabulary (IEV) [IEC Publication 50 (151)].

2.4.1 *Type test*

A test of one or more devices made to a certain design to show that the design meets certain specifications (IEV 151-04-15).

2.4.2 *Routine test*

A test to which each individual device is subjected during or after manufacture to ascertain whether it complies with certain criteria (IEV 151-04-16).

2.4.3 *Sampling test*

A test on a number of devices taken at random from a batch (IEV 151-04-17).

2.4.4 *Acceptance test*

A contractual test to prove to the customer that the device meets certain conditions of its specification (IEV 151-04-20).

2.5 *Other definitions*

For the definitions of general terms in this standard, reference should be made to IEC Publication 50 or to special definitions laid down in IEC Publication 743.

3. Requirements

3.1 *General requirements*

3.1.1 Insulated and insulating hand tools shall be manufactured and dimensioned in such a way that they do not constitute a danger for the user or the installation if they are properly used.

3.1.2 The mechanical specifications for insulated hand tools and those for insulating hand tools having a similar function shall comply with the corresponding ISO Standards. The mechanical specifications of the working parts of the tools shall be maintained even after application of an insulating layer.

Insulating hand tools specially designed for live working in an environment of live parts at different potentials (boxes with electrical equipment, live working on underground cables, etc.), that are generally used to hold or move live conductors or to cut wires of small section, must have adequate mechanical properties to avoid the risk of breaking and the possible corresponding electrical consequences. These tools shall be checked for compliance with Sub-clause 4.8.

3.1.3 The insulating material shall be selected according to the electrical, mechanical and thermal stresses to which it may be exposed during use. In addition, the insulating material shall have an adequate resistance to conditioning and be flame retardant.

The insulating coating may consist of one or more layers. If two or more layers are adopted, constrasting colours may be used. When the inner layer is visible after the destruction of the external layer, it is an indication that the tool should be replaced (the inner layer may be transparent).

Notes 1.- In the case of an insulating coating consisting of several layers, an acceptance test, such as the dielectric test of Sub-clause 4.4, on the inner layer should be required by the purchaser.

2.- The insulating surface should have a slip resistant texture.

3.1.4 The service ability of the tools shall not be impaired within the temperature range -20 °C to +70 °C.

The insulating material applied on tools shall adhere securely to the conductive part from -20 °C to +70 °C.

Note.- If it is anticipated that the tools will be used at extremely high or extremely low temperature, other tests will be necessary. They will be given in an amendment to this standard.

3.1.5 Double ended tools, such as box wrenches, keys for hexagonal socket screws, socket wrenches, double-head open-end wrenches, etc., are not allowed for insulated tools but are allowed for insulating tools.

3.1.6 Detachable heads of tools shall be capable of being locked to the tools to avoid unintentional separation.

3.1.7 In the case of connecting parts of tools requiring assembly, the insulation shall be applied in such a manner that if any part becomes detached during use, no conductive part, which may still be live, can be inadvertently touched or cause a disruptive discharge.

3.2 *Additional requirements*

3.2.1 *Screwdrivers and wrenches*

3.2.1.1 The following uninsulated areas and lengths on the working head are permissible (Figure 1, page 34):

- screwdrivers for slotted-head screws: maximum length of 15 mm,
- other types of screwdrivers: (Philips-end, square, hexagonal), maximum length 18 mm.

  Note.- For special uses, at the request of the purchaser, length may be reduced.

- engineers' wrenches: the operative part of the open end,
- box wrenches: the operative part of the open end and the contact area.

3.2.1.2 Insulation of the blade of screwdrivers shall be attached to the handle. The thickness of the insulation over a length of 30 mm in area c of Figure 1 shall not exceed 2 mm.

3.2.2 *Pliers, strippers, cable scissors, cable-cutting tools having legs up to 400 mm*

The leg insulation shall have a guard so that the hand cannot slip towards the uncovered metal parts of the head (see Figure 2a, page 35).

The height of the guard shall be sufficient to preclude the slipping of the fingers towards the conductive part during the work.

For pliers, the minimum dimensions of the guard shall be (see Figure 2a, page 35):

- 10 mm on the left and on the right of the pliers held on a flat surface,
- 5 mm on the front and on the back of the pliers held on a flat surface.

The minimum insulated distance between the inner edge of the guard and the non-insulated part shall be 12 mm. The insulation portion of the guard shall extend as far as possible towards the working head (see Figure 2a).

In the case of a slip joint, a guard of 5 mm shall be provided for the inner part of the legs.

3.2.3 *Tools with legs longer than 400 mm*

If the legs of the tools are longer than 400 mm, a guard is not required.

3.2.4 *Knives*

The minimum length of the insulated handle shall be 100 mm.

The handle shall have a guard on the side towards the working head to preclude the slipping of the hand towards the conductive part during the work. The minimum height of the guard shall be 5 mm.

The minimum insulated distance between the inner edge of the guard and the non-insulated part shall be 12 mm (see Figure 2b, letter b, page 35).

The uninsulated part of the knife blade shall be not longer than 65 mm (see Figure 2b, letter c).

3.2.5 *Marking*

Each tool and/or tool component shall be legibly and permanently marked with the following inscriptions:

- marking or origin (manufacturer's name or trade mark) on the metal part or on the insulating material layer of the tool,
- type reference,
- year of manufacture (at least the last two digits of the year),
- symbol with indication of the electrical working limit: 1 000 V a.c.; the symbol shall be at least 3 mm high; the letters and the figures shall be at least 2 mm high (see Figure 3, page 36).

The tools shall bear no voltage markings apart from those described above.

Note.- For example, the indication of a test voltage may lead to the assumption that the tool is suitable for work at that voltage.

3.2.6 *Instructions for use*

In the case of tools which require assembly, the proper method shall be stated in the instructions for use.

4. Type tests

4.1 *General test specifications*

Compliance with the mechanical specifications according to Clause 3 shall be checked by means of the following type tests:

The tests according to Sub-clauses 4.2 to 4.10 shall be carried out on one and the same test pieces and in the sequence of the sub-clauses mentioned.

The type test shall be carried out on at least three test pieces.

If there is any change in the design or the manufacture of the tool since the last type test, the type test shall be repeated.

Should a test piece fail any part of the type test, the type test shall be repeated on at least six test pieces. Should only one test piece fail in any of the type tests, the whole test shall then be regarded as having been failed.

Unless otherwise stated in the specification, the test shall be carried out after a minimum storage time of 16 h under IEC climatic conditions, 23 ± 5 °C, relative humidity 45% to 75%.

Unless otherwise stated in the specification, deviations of ±5% from any test values required are permissible.

4.2 *Visual and dimensional check*

4.2.1 *Visual check*

The tool (in particular the insulation) shall be visually checked and stated to be free from external defects.

The marking shall be checked for legibility and completeness in accordance with Sub-clause 3.2.5.

4.2.2 *Dimensional check*

The dimensions shall be checked according to Clause 3.

4.3 *Low-temperature impact test*

The tool shall be conditioned by placement in a cooling chamber for 2 h at -25 ± 3 °C.

The impact test shall be carried out between two and three minutes after removal from the cooling chamber at an ambient temperature of 23 ± 5 °C.

The test shall be carried out according to one of the two alternatives shown in Figures 4a and 4b, pages 37 and 38. The hardness of the hammer shall be at least 20 HRC. The fall height H shall be determined as a function of its weight P, so that the energy W of the impact on the tool to be tested shall be equal to that of this tool falling from a height of 0.60 m onto a hard surface:

$$H = \frac{W}{P} = \frac{0.6 \times F.}{P}$$

where:

H is the fall height of the hammer, in metres
F is the weight of the tool tested, in newtons
P is the weight of the hammer, in newtons

The points of impact shall be those which could be damaged if the tool should be dropped on a flat surface (in particular the insulated extremities of the handle or legs of the tool).

The test is successful if the insulating material shows no break, exfoliation or crack penetrating the insulating layer of the insulated tool, or likely to reduce the solidity of the insulating tool.

4.4 *Dielectric test*

4.4.1 *Conditioning*

Before testing, the tools shall be conditioned by immersion in a bath of tap water at room temperature for 24 ± 0.5 h. After this conditioning, the tools shall be wiped and submitted to the dielectric test.

4.4.2 *Insulated tools*

The test piece shall be immersed with its insulated part in a bath of tap water up to a level of 24 ± 2 mm from the nearest non-insulated part. The conductive part shall be above the water level (see Figure 5, page 39).

Pliers and similar tools shall be tested in such a position that the gap d between the two inner sides of the insulated legs is 2 mm to 3 mm, or the minimum possible by the tool's construction but not less than 2 mm (see Figure 5).

For tools with detachable heads, the water bath shall be replaced by a bath of nickel stainless steel balls 3 mm in diameter (measured with normal industrial tolerances).

A voltage of 10 kV r.m.s. at 50 Hz or 60 Hz shall then be continuously applied for 3 min according to IEC Publication 60, and the leakage current is measured. This current shall be smaller than 1 mA for 20 mm of coated tool. This corresponds to a maximum value of the leakage current of:

$$I = 5L$$

where:

I (mA) is the leakage current rounded to the upper value in milliamperes

L (m) is the developed length of coating (rounded to the lower value in centimetres).

Note.- Appendix A gives examples of calculation of the developed length of coating and the limits of acceptable leakage current.

Tools capable of being assembled shall be tested in all possible variations. Tools with holding devices shall be tested on both end positions, if applicable.

The test is successful if no electrical puncture, sparkover or flashover occurs during the test period, and if the limits of leakage current are not exceeded.

4.4.3 *Insulating tools*

4.4.3.1 *Dielectric test between the working head and the handle (or legs)*

- Tools having only one working head with or without a metallic part (insert):

The working head shall be covered with conductive tape or conductive paint in contact with all possible exposed conductive parts of the working head. The body of the tool (one handle or two legs) shall also be covered with conductive tape or conductive paint in the places usually touched by the user's hand (guard included). The distance between the conductive tape placed on the working head, or any metallic part connected to it, and the conductive tape placed on the body of the tool nearest to the working head shall be 22 ± 2 mm (see Figure 6a, page 40).

A voltage of 10 kV r.m.s. at 50 Hz or 60 Hz shall be continuously applied for 3 min, according to IEC Publication 60, between the working head and the handle (or legs) of the tool; the leakage current is measured.

The test is successful if no electrical puncture, sparkover or flashover occurs during the test period, and if the leakage current measured is less than 0.5 mA.

- Tools having two or more working heads:

The same test as above shall be repeated in all configurations.

4.4.3.2 *Dielectric test of the handle or legs*

Note.- The purpose of this test is to check the dielectric quality of the material used for the handle or legs.

Electrodes of conductive tape or conductive paint 5 mm wide are placed on the surface of the handle or legs at intervals of 40 mm (see Figure 6b, page 40), in accordance with IEC Publication 60. A voltage of 10 kV r.m.s. at 50 Hz or 60 Hz shall then be continuously applied for 3 min between two consecutive electrodes.

The test is successful if no electrical puncture, sparkover or flashover occurs during the test period and if the leakage current is less than 0.5 mA multiplied by the number of spaces between the electrodes.

4.5 *Indentation test (for insulated tools)*

All parts of the insulating coating, electrically tested as indicated in Sub-clause 4.4, shall pass this test. The test shall be performed on the most vulnerable part(s) for screwdrivers with insulated blades, and for other tools at the external middle part of the handle or legs.

If the radius *r* at the test point is ≥10 mm, the test shall be made with a test device according to Figure 7a, page 41, in a heating chamber with natural ventilation. The part of the mass m in contact with the test piece shall be a stainless steel hemispheric nose-piece of 5 mm diameter. The applied force *F* shall be 20 N.

If the radius *r* at the test point is less than 10 mm, a rod of 4 mm diameter and at least 30 mm in length placed at right angles to the tool axis shall be used with the same force *F* of 20 N (see Figure 7b, page 41).

The tool shall be clamped in such a way that the insulating material coating at the test point is in a horizontal position. After setting up the testing device, the arrangement shall be held according to code 2 h/70C/<20% of IEC Publication 212. At the end of the heating time and after a cooling period outside the chamber of 5 min, a voltage of 5 kV r.m.s. at 50 Hz or 60 Hz shall be applied continuously, in accordance with IEC Publication 60, between the testing device and the metal part of the tool for 3 min, using the code 18-28C/45-75% of IEC Publication 212.

The test is successful if no electrical puncture, sparkover or flashover occurs during the test period.

4.6 *Test for adhesion of the insulating material coating (for insulated tools)*

4.6.1 *Conditioning*

The tools shall be conditioned before the tests in a heating chamber with normal ventilation at a temperature of 70 ± 2 °C for 168 h.

The following tests shall be carried out at ambient temperature between the third and fifth minute after removal from the heating chamber, using code 18-28C/45-75% of IEC Publication 212.

4.6.2 *Test on the working head*

The test shall be made on the following tools:

- wrenches;
- open-jaw holding wrenches;
- tools capable of being assembled (except for pieces acting as screwdrivers).

The test may be carried out using either Method A or Method B as shown in Figures 8a and 8b (pages 42 and 43) respectively.

Method A (see Figure 8a):

A hook having a cutting edge of 5 mm width shall be placed on the working head in such a manner that it does not touch the conductive part.

A force *F* of 50 N shall be applied in the direction of the line dividing the insulating material coating from the conductive part for 3 min.

Method B (see Figure 8b):

A device having two cutting edges, each of 5 mm width, shall be placed on the working head in such a manner that it does not touch the conductive part.

A force *F* of 100 N shall then be applied in the direction of the line dividing the insulating material coating from the conductive part for 3 min.

Either test is considered passed if the insulating material coating does not move more than 3 mm from its initial location on the conductive part, and without any breakage of the insulating material.

.6.3 *Test on the insulation of the blades of screwdrivers*

The test shall be carried out on a screwdriver with the testing apparatus as shown in Figure 9, page 44.

The penetration depth of the cutting edges of the testing apparatus shall not exceed 50% of the thickness *t* of the insulating material coating. The cutting edges shall be placed on the blade insulation 10 mm to 15 mm from the point where the blade emerges from the handle.

If the cutting edges slide on the insulation it is permissible to cut a groove in the blade insulation of up to 50% of its thickness,-to prevent movement.

The force *F* in newtons shall be equal to 35 times the blade diameter or 35 times the greatest dimension of the blade cross-section in millimetres. It shall be applied in the axial direction of the blade for 1 min.

The test is considered passed if the insulating coating does not move more than 3 mm from its initial location on the conductive part and if there is no breakage of the insulating material.

.6.4 *Test of adhesion of the insulation of the complete tool*

The test shall be made on pliers, strippers, cable-cutting tools, cable scissors and knives with the testing apparatus according to Figure 10, page 45.

The force *F* of 500 N shall be applied for 3 min.

The test is considered passed:

- if the handle or legs remain firmly attached to the conducting part,
- and if the guard(s) remain firmly attached to the handle or legs.

Note.- Deformation of the insulating coating is not considered as a failure.

4.7 *Flame retardancy test*

The test shall be carried out in a draught-free room. The test piece shall be clamped in a horizontal position. A small burner shall be arranged in such a way that the axis of the burner nozzle and the axis of the handle of the tool are at right angles and form a vertical plane.

The gas supply shall be technical grade methane gas with a suitable regulator and meter to produce a uniform gas flow

Note.- If natural gas is used as an alternative to methane, its heat content should be approximately 37 MJ/m^3, which has been found to provide similar results.

The nozzle of the burner shall have a diameter of 9.5 ± 0.5 mm to produce a 20 ± 2 mm high blue flame.

The burner is placed remote from the test piece, ignited and adjusted in the vertical position to produce a blue flame 20 ± 2 mm high. The flame is then obtained by adjusting the gas supply and the air ports of the burner until a 20 ± 2 mm yellow-tipped blue flame is produced; the air supply is then increased until the yellow tip disappears. The height of the flame is measured again, and corrected if necessary.

The burner shall then be placed in the test position as shown in Figure 11, page 46, with the axis of the flame at right angles to that of the tool.

At the start of the test, the tip of the testing flame shall touch the insulating material at the lower part of the working head facing the test piece (see Figure 11).

The horizontal reference line No. 4 of Figure 11 at the level of the lower end of the insulating material is the datum for measuring the flame height.

If different types of insulating material are used for the same tool, the test shall be made on each individual type of insulating material.

The testing flame shall act upon the test piece for 10 s. After this period, the flame shall be withdrawn. It shall be ensured that no air draught interferes with the test.

The propagation of the flame on the test piece shall be observed for 20 s after the withdrawal of the testing flame.

The test is considered passed if the flame height *h* on the test piece does not exceed 120 mm during the 20 s of the observation period.

4.8 *Mechanical tests*

4.8.1 *Insulated tools*

The tools shall comply with all the specific mechanical specifications of ISO standards corresponding to the different types of tools. The manufacturer shall provide the reports of these tests at the request of the customer.

4.8.2 *Insulating tools*

4.8.2.1 Tools the shape and function of which are identical to those of insulated tools, such as wrenches, cutting edges of nippers, etc., shall also comply with the corresponding mechanical requirements of applicable ISO standards.

4.8.2.2 *Pliers and nippers*

These tools shall be tested as follows:

a) Bending test on the legs (see Figure 12, page 47)

A force F in newtons shall be applied to the legs as indicated in Figure 12 for 3 min. If L in millimetres is smaller than 100 mm, $F = 0.5\ L$; if L is equal to or greater than 100 mm, $F = 50$ N.

The test is considered passed if there is no break of any part of the tool and if the ends of the legs do not meet.

b) Torque test (see Figure 13, page 48)

The pliers shall be connected via a test piece to a device capable of measuring the torque.

In the case of flat-nose pliers, the test piece shall be of steel, 12 mm wide and 3 mm thick. It shall be inserted into the jaws for a distance of 6 ± 1 mm.

In the case of round-nose pliers, the test piece shall have two parallel holes or grooves with centre-axis and diameter adapted to allow the plier noses to be inserted to a depth of 6 ± 1 mm. The edges of the holes or grooves shall be rounded.

The test pieces shall have a hardness of at least 50 HRC.

The legs of the pliers shall be tightened between the points A and B defined by the length *b*, with a force P equal to the force F indicated for the bending test.

F (newtons) = 0.5 L (millimetres) with a maximum of 50 N.

The legs of the pliers shall be correctly held in order to be able to resist the torque.

Pliers and nippers shall withstand a torque of 5 N.m without any visible permanent deformation.

4.9 *Locking test*

Tools that consist of more than one part shall be assembled in accordance with the manufacturer's instructions.

4.9.1 *Tools with spring-loaded balls*

For detachable tools with spring-loaded balls, the following values shall be used:

4 N for the square drive of 6.3 mm
11 N for the square drive of 10 mm
30 N for the square drive of 12.5 mm
80 N when the square drive exceeds 12.5 mm.

4.9.2 *Tools with screwed fittings*

In the case of screwed fittings, a load of 500 N shall be used.

4.9.3 *Procedure and results*

The load shall be gradually applied along the dismantling direction to reach the value given in Sub-clauses 4.9.1 and 4.9.2 within 2 s; it shall then be held for 1 min.

The test is considered passed if the assembly does not come apart.

4.10 *Durability of marking*

If there is any doubt about the durability of the marking, the tools shall be rubbed for 15 s with a rag soaked in water and then for 15 s with a rag soaked in a suitable solvent.

After this rubbing, the marking shall still be legible.

Note.- For special service requirements the purchaser may specify the extra tests of the durability of the marking.

5. Routine tests

5.1 *Visual check*

A visual check according to Sub-clause 4.2.1 shall be carried out.

5.2 *Dielectric test*

5.2.1 Tools shall be tested according to Sub-clause 4.4 but with the following modifications:

- conditioning as specified in Sub-clause 4.4.1, is not necessary;

- the test time shall be 10 s after reaching the specified voltage;

- the leakage current measurement shall not be carried out.

5.2.2 Tools with detachable parts shall be tested either as a complete assembly or as separate parts.

The test method used shall be equivalent to the requirements for surface contact as specified in Sub-clause 4.4.2.

6. Sampling tests

6.1 *Dimensional check*

A dimensional check according to Sub-clause 4.2.2 shall be carried out using ISO Standard 2859 sampling procedures and corresponding to the following table:

Batch or lot size	Sample size	Acceptance number	Rejection number
2 to 15	2	0	1
16 to 25	3	0	1
26 to 90	5	0	1
91 to 150	8	0	1
151 to 500	13	1	2
501 to 1 200	20	1	2
1 201 to 10 000	32	2	3

Note.- For larger batch or lot sizes, see ISO Standard 2859:

- special inspection level, see S-4 in Table I;
- the single sampling plan for normal inspection in Table II-A, in the column for the acceptable quality level (AQL) 2.5.

6.2 *Destructive tests*

The following tests:

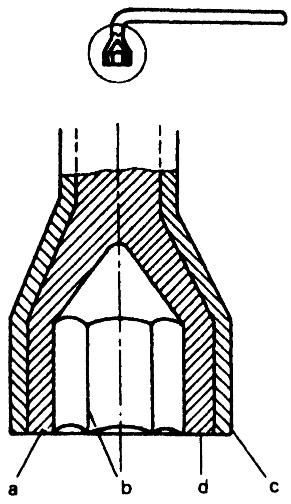
- low-temperature impact test according to Sub-clause 4.3;
- dielectric test according to Sub-clause 4.4;
- indentation test according to Sub-clause 4.5;
- adhesion test according to Sub-clause 4.6;
- flame retardancy test according to Sub-clause 4.7;
- mechanical tests according to Sub-clause 4.8,

shall be carried out with the following ISO sampling procedures (see ISO Standard 2859):

- for batch or lot sizes of 2 to 35 000, the sample size shall be 2, the acceptance number shall be 0 and the rejection number shall be 1,
- for larger batch or lot sizes (see ISO Standard 2859):
  - special inspection level, see S-1 in Table I,
  - the single sampling plan for reduced inspection in Table II-C, in the column for the acceptable quality level (AQL) of 2.5.

Acceptance tests

The purchaser shall specify these tests in the contract with the manufacturer (see Appendix B).



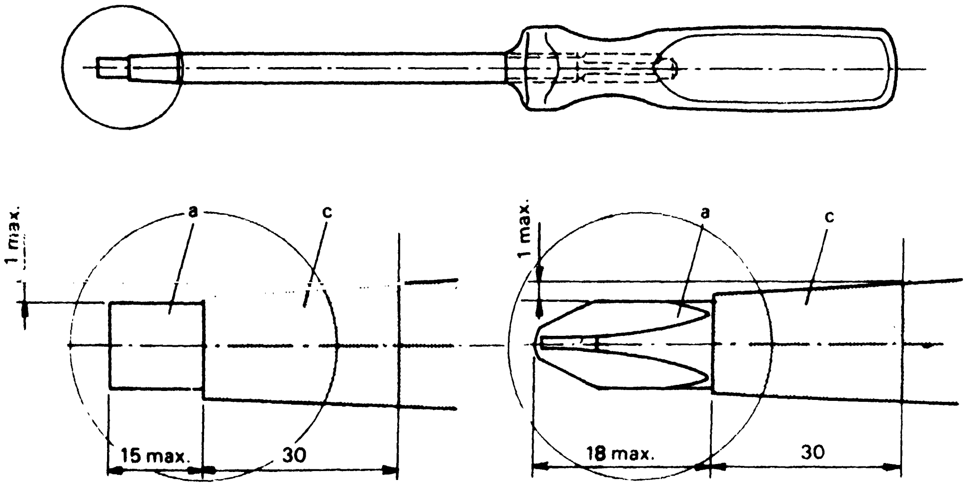
a = conductive part

b = working part

c = insulation

d = contact area

Sub-clause 3.2.1.2



Dimensions in millimetres

Fig. 1. - Illustrations of insulation of typical tools (examples).

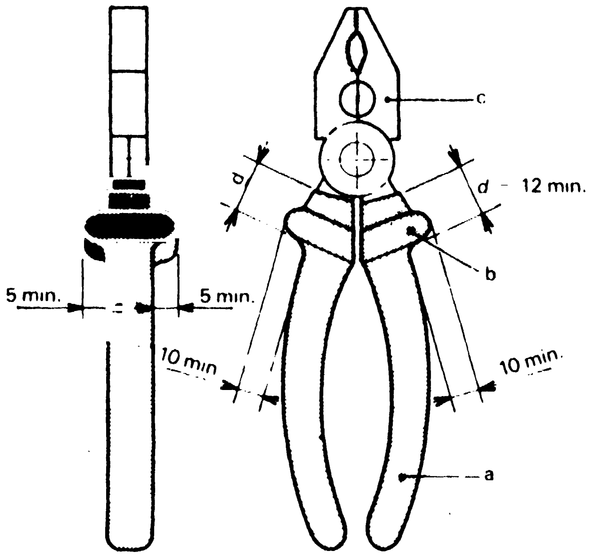
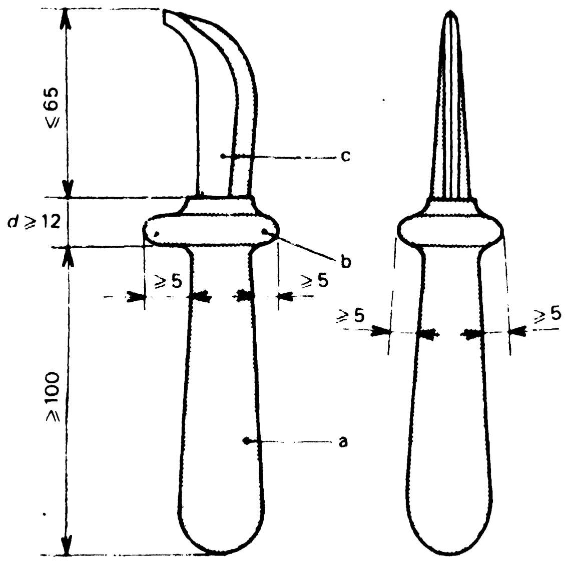


Fig. 2a. - Insulation of pliers (Sub-clause 3.2.2).



Dimensions in millimetres

Fig. 2b. - Insulation of knives (Sub-clause 3.2.4).

a = insulated handle or leg

b = guard

c = working head (not insulated)

d = distance between the inner edge of the guard and the non-insulated part

Fig. 2. - Illustrations of insulation of pliers and knives.

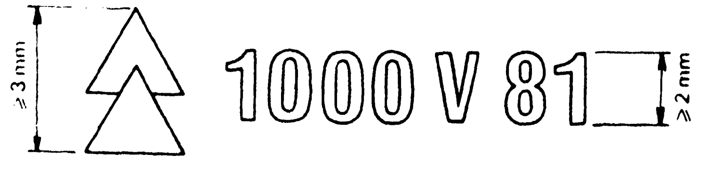
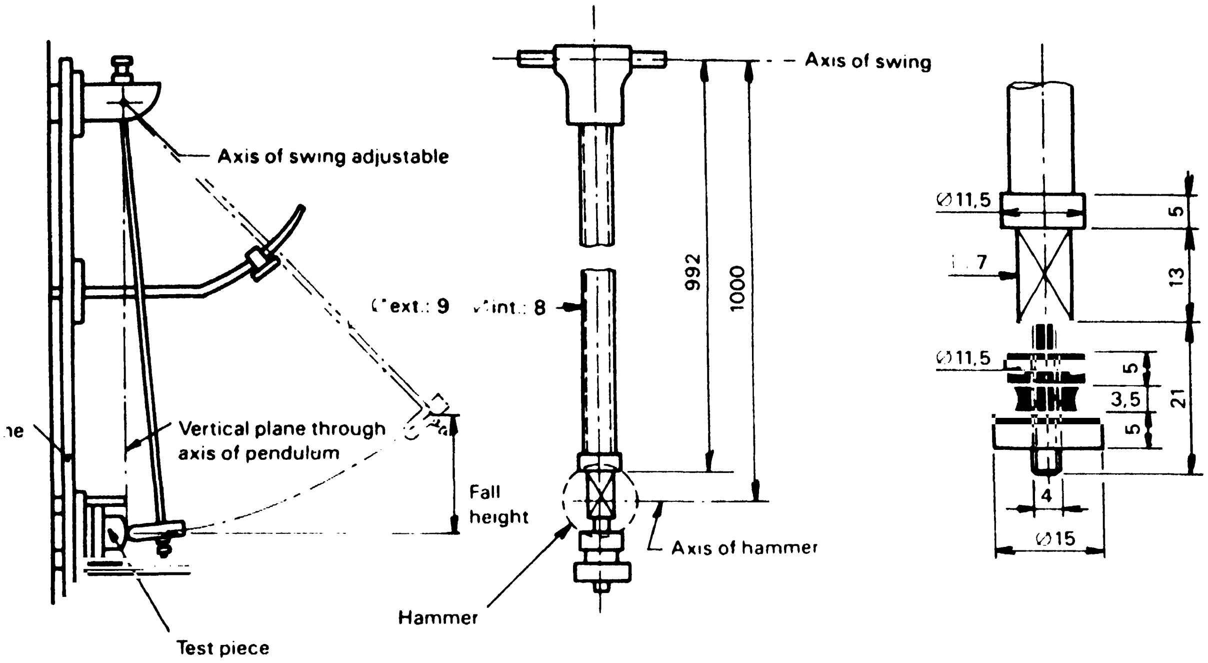
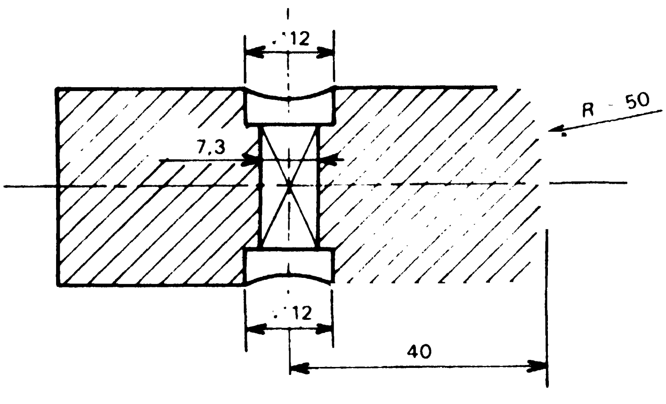


Fig. 3. - Marking symbol (Sub-clause 3.2.5).

Method A



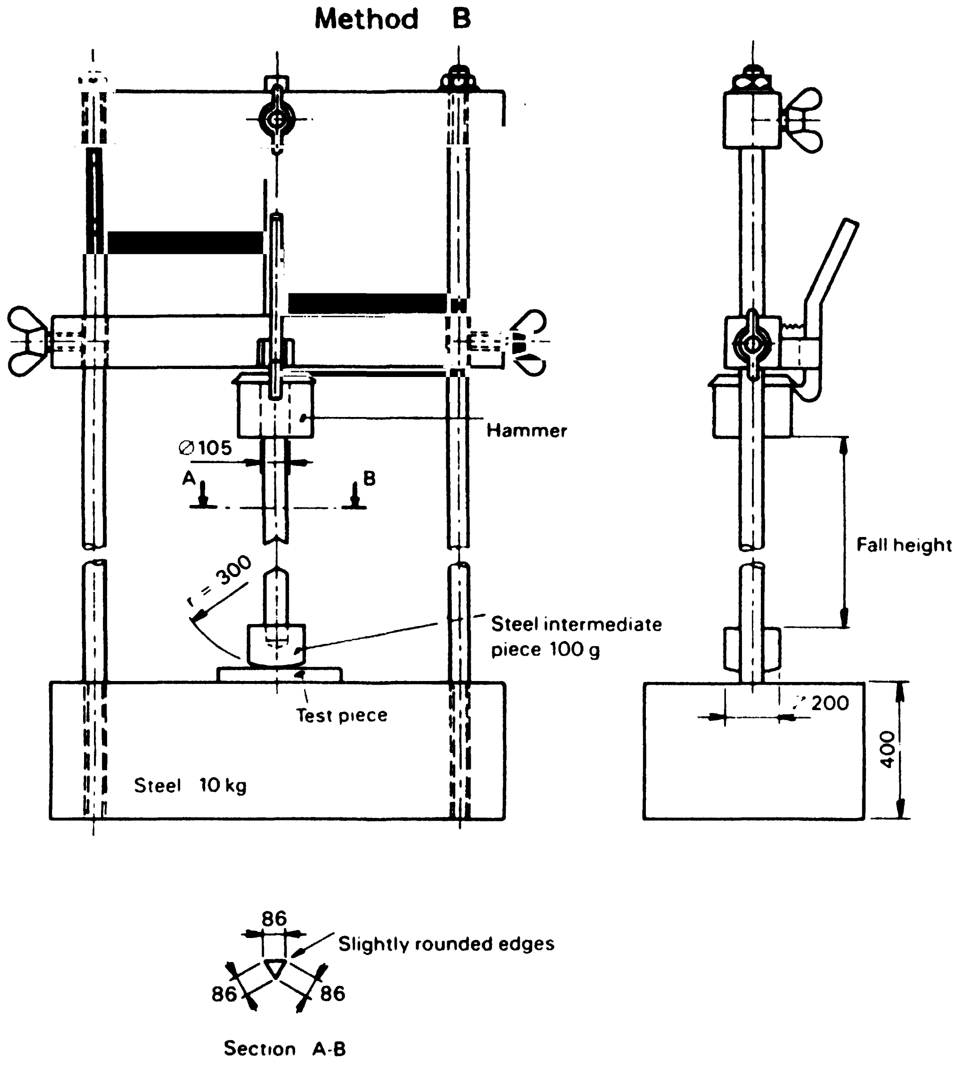
Pendulum for impact test



Hammer

Dimensions in millimetres

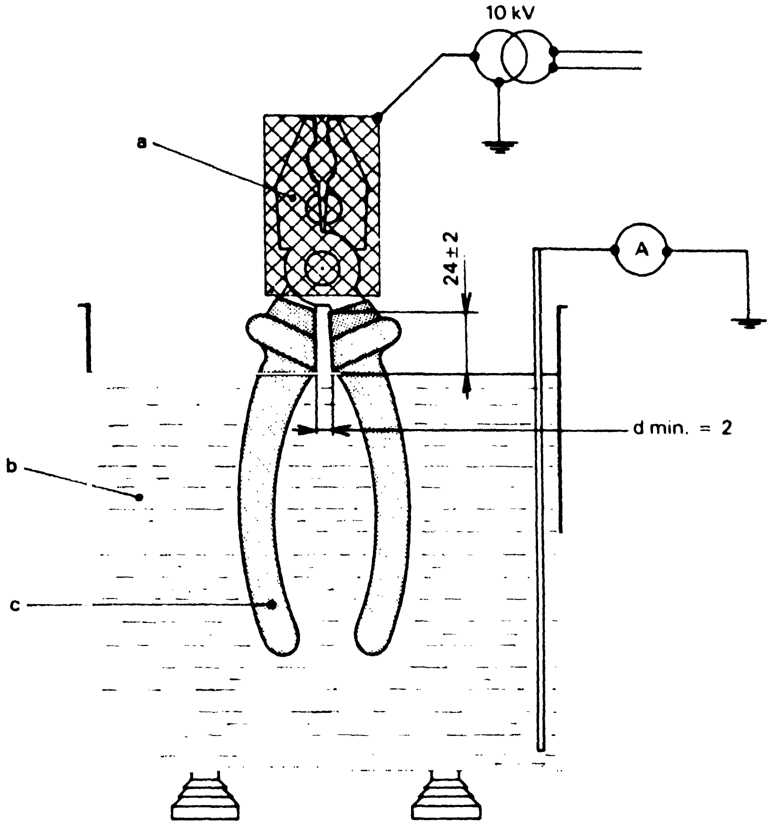
Figure 4a.



Dimensions in millimetres

Figure 4b.

Fig. 4. - Example of a test arrangement for the low-temperature impact test (Sub-clause 4.3).



Dimensions in millimetres

a = conductive working head

b = tap water bath

c = insulated part of the tool

d = gap to be maintained between the two inner sides of the legs

Fig. 5. - Electric testing device for insulated tools (Sub-clause 4.4.2).

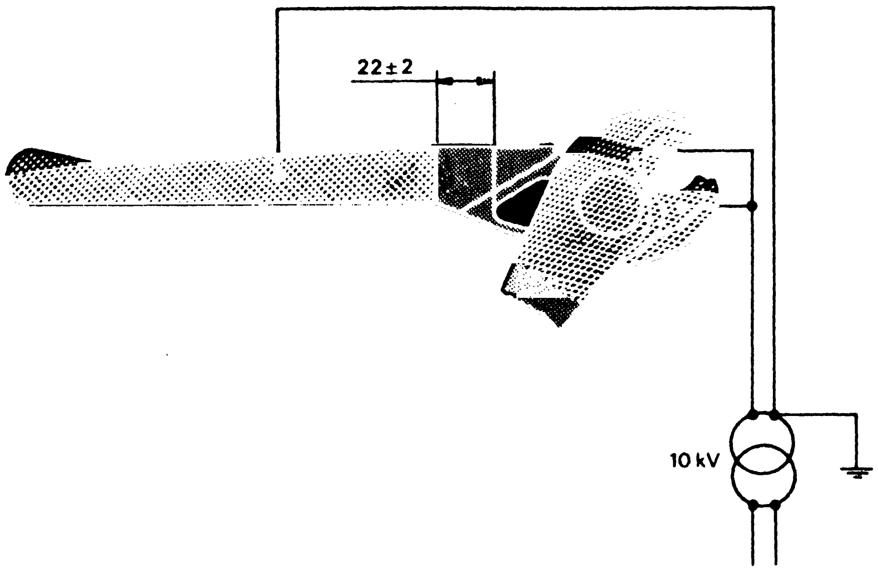
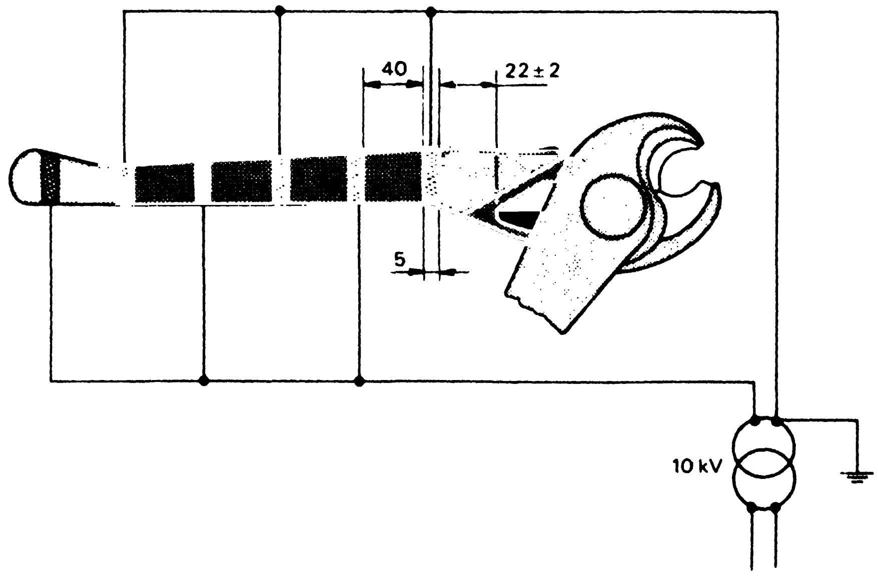


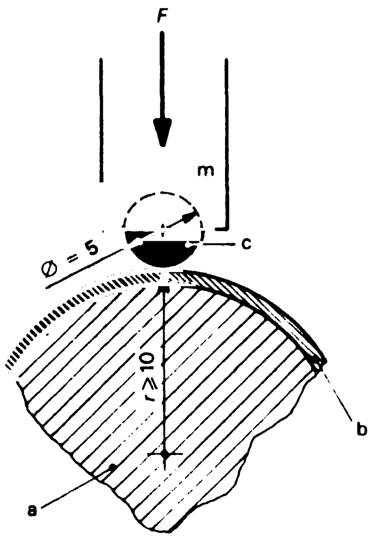
Fig. 6a. - Dielectric test between the working head and the handle or the legs (Sub-clause 4.4.3.1).



Dimensions in millimetres

Fig. 6b. - Dielectric test of the handle or legs (Sub-clause 4.4.3.2).

Fig. 6. - Dielectric testing device for insulating tools



Dimensions in millimetres

a = conductive part

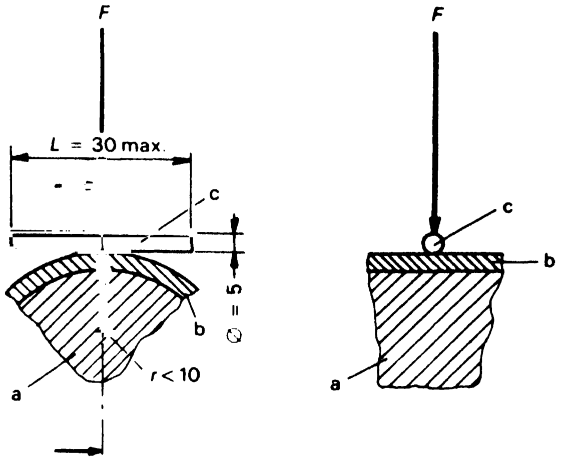
b = insulation (test point)

c = hemispheric nose-piece

r = radius at the test point of the tool

m = testing mass

Fig. 7a. - Radius at the test point of the tool ≥ 10 mm.



Dimensions in millimetres

a = conductive part

b = insulation (test point)

c = rod

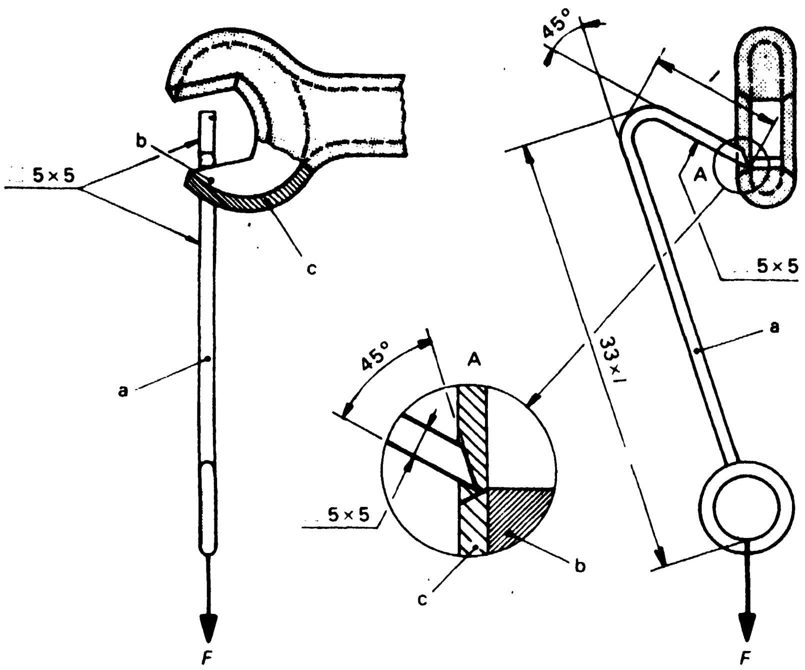
r = radius at the test point of the tool

Fig. 7b. - Radius at the test point of the tool < 10 mm.

Fig. 7. - Indentation test (Sub-clause 4.5).

Method A

Test on the working head



Dimensions in millimetres

a = hook (the length of the leg depends on the size of the tool)

b = conductive parts

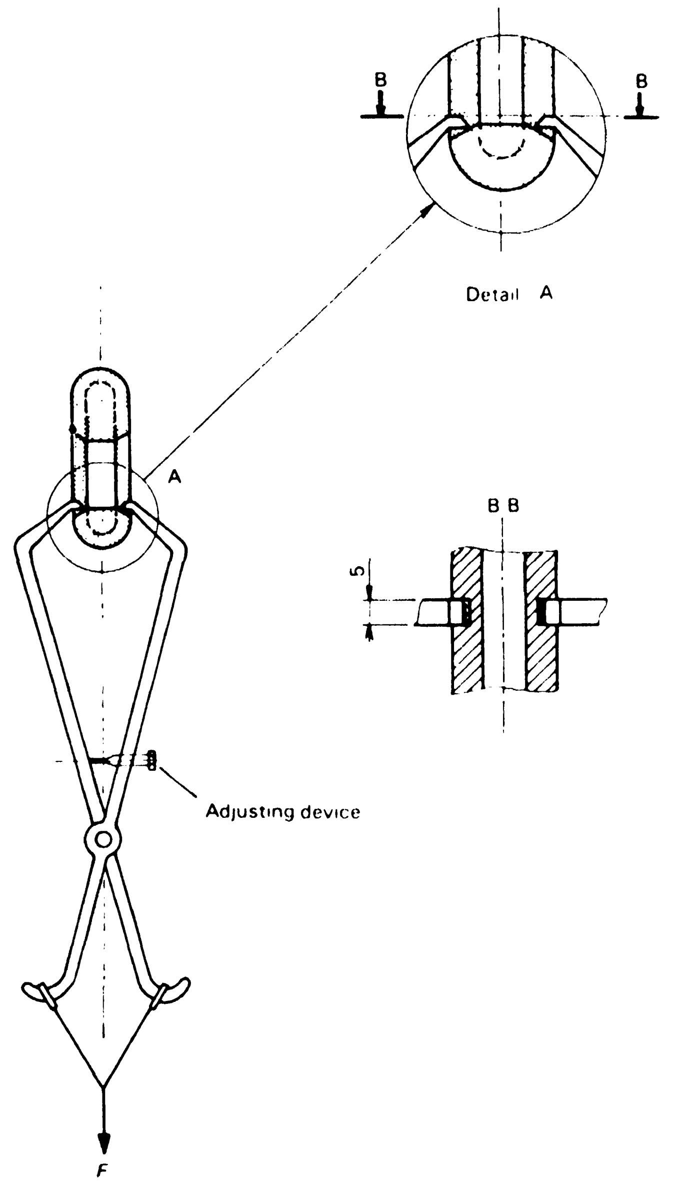
c = insulating material coating

l = length of the short arm of the hook

Figure 8a.

Method B

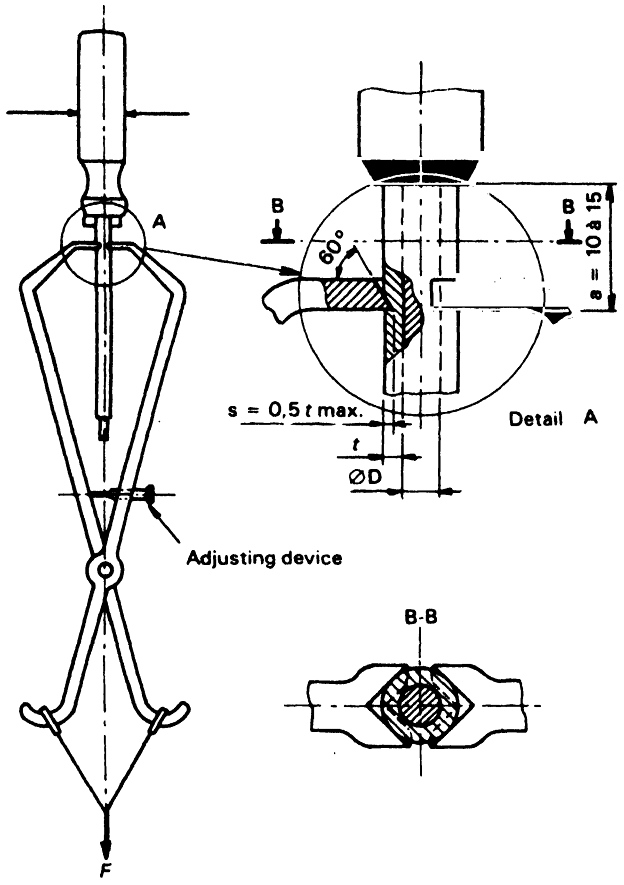
Test on the working head



Dimensions in millimetres

Figure 8b.

Fig. 8. - Principle of the testing device for checking adhesion of the insulating coating on metallic parts of the tools (Sub-clause 4.6.2).



Dimensions in millimetres

s = depth of penetration (s = 0.5 t max.)

t = thickness of the insulating material coating

F = testing force

a = spacing between the point where the blade comes out of the handle and the cutting edge of the testing appliance

Fig. 9. - Testing device for checking adhesion of the insulating coating of screwdrivers on conductive parts (Sub-clause 4.6.2) and the handle (Sub-clause 4.6.3).

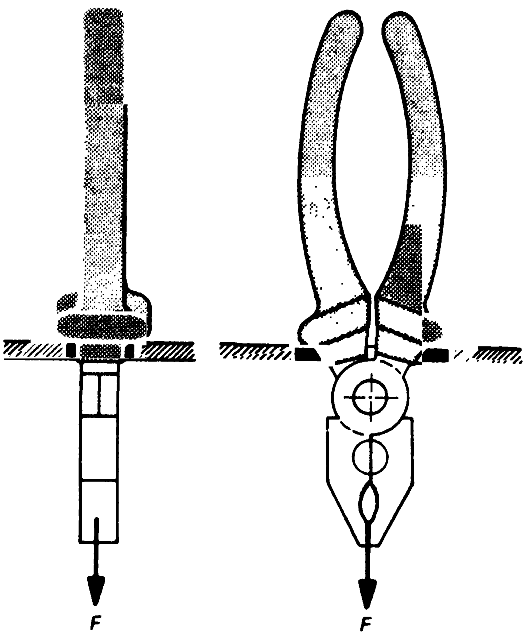


Figure 10a.

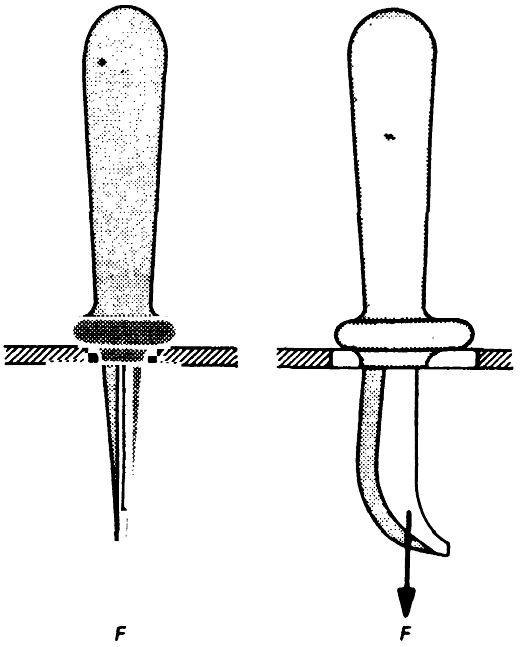
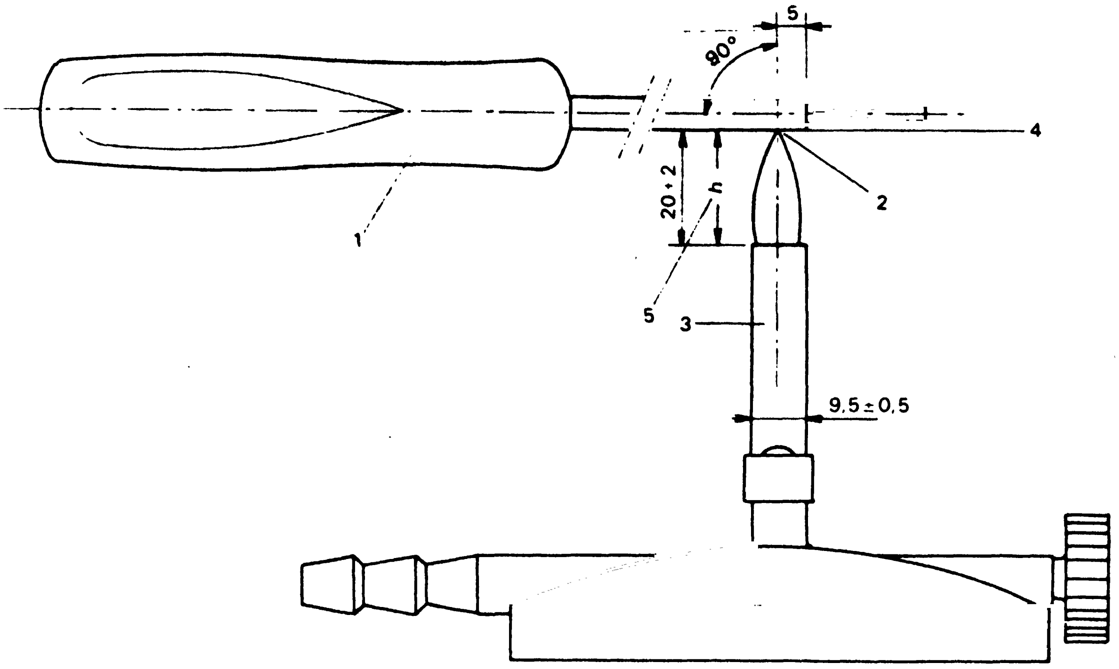


Figure 10b.

g. 10. - Example of mountings for checking stability of adhesion of the insulation of the entire tool (Sub-clause 4.6.4).



Dimensions in millimetres

1 : test piece

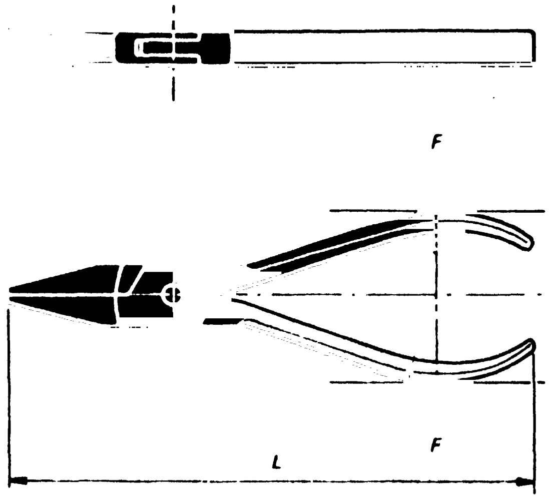
2 : tip of the flame

3 : burner

4 : horizontal reference line

5 : maximum flame height h

Fig. 11. - Example of a flame retardancy test arrangement (Sub-clause 4.7).



F (newtons) = 0.5 L (mm), with a maximum of 50 N

Fig. 12. - Insulating pliers. Bending test on legs (Sub-clause 4.8.2.2, Item *a*)).

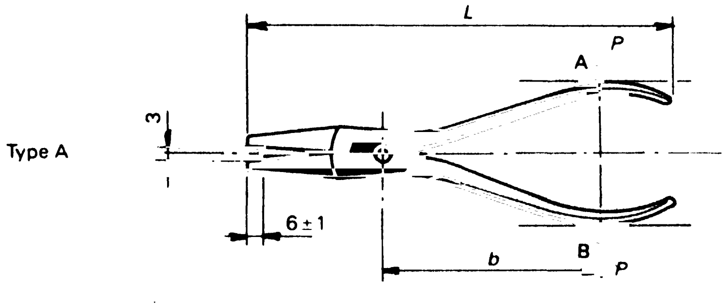
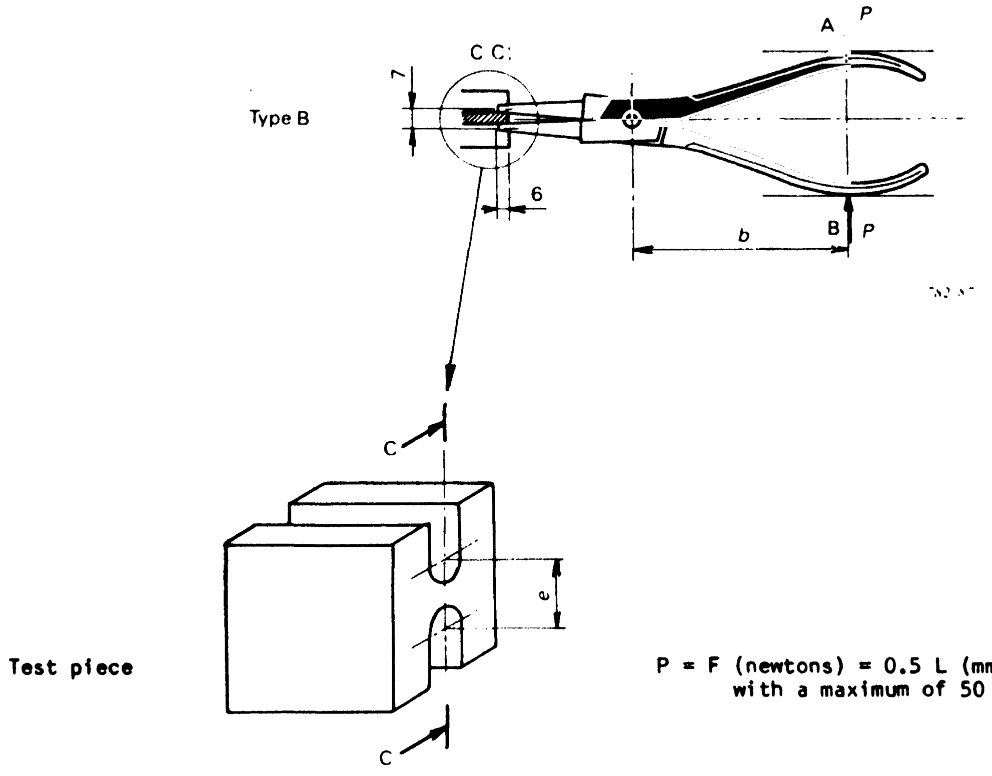


Figure 13a.



P = F (newtons) = 0.5 L (mm)
with a maximum of 50 N

Dimensions in millimetres

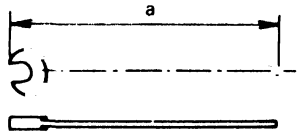
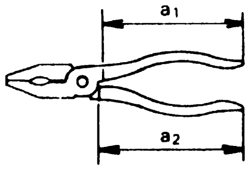
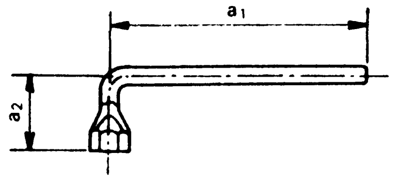
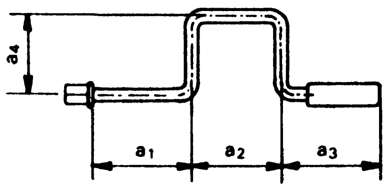
e = the distance between the axis of the holes depends on the dimensions of the nose

Figure 13b.

Fig. 13. - Insulating pliers. Torque test
(Sub-clause 4.8.2.2, Item *b)*).

APPENDIX A

Examples of calculation of the developed length of coating and acceptable leakage current

Designations	Developed length of coating L	Limits of acceptable leakage current $I_M = 5L$
 Engineers' wrench, single head	$L = a$ *Example:* for a 22 mm wrench $L = a = 0{,}20$ m	$5L = 1$ $I_M = 1$ mA
 All-purpose pliers	$L = a_1 + a_2 = 2a_1$ *Example:* $a_1 = a_2 = 0{,}14$ m $L = 0{,}28$ m	$5L = 1{,}4$ rounded to $I_M = 2$ mA
 Socket wrench, single head	$L = a_1 + a_2$ *Example:* $a_1 = 0{,}10$ m $a_2 = 0{,}30$ m $L = 0{,}40$ m	$5L = 2$ $I_M = 2$ mA
 Speed brace	$L = a_1 + a_2 + a_3 + 2a_4$ *Example:* $a_1 = 0{,}30$ m $a_2 = 0{,}15$ m $a_3 = 0{,}15$ m $a_4 = 0{,}25$ m $L = 1{,}10$ m	$5L = 5{,}50$ rounded to $I_M = 6$ mA

APPENDIX B

ACCEPTANCE TESTS

As defined in IEV 151-04-20, an acceptance test is a contractual test to prove to the customer that the device meets certain conditions of its specification. These tests may be carried out on every unit (routine tests) or on a sampling of the units (sampling tests).

If a customer indicates in his specification that the device must meet this IEC specification only, the acceptance tests are those (both routine and sampling) which are specified in this document.

The customer may however, if he wishes, ask for additional tests or modify the sampling size, but must include this in his own specification.

The customer may wish to witness the tests, have someone witness them or simply accept the results of the tests as carried out by the manufacturer. He may also specify that the tests be carried out in an independent laboratory of his choosing or even in his own laboratory.

Further, the customer may specify the additional tests or larger sampling sizes when he is purchasing from a new manufacturer, because he has experienced problems with a particular manufacturer, or because he is purchasing a new product or a new design.

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